

Short Communication

Notes on the Pollination of *Cypripedium macranthos* var. *speciosum* and *Dactylorhiza aristata* (Orchidaceae)

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Anthecological observations on two Japanese orchids, *Cypripedium macranthos* var. *speciosum* and *Dactylorhiza aristata*, were preliminarily carried out. The results suggested that nectarless flowers of *C. macranthos* var. *speciosum* and *D. aristata* are pollinated by small bees including *Andrena ruficrus ruficrus* and by queen bumblebees, respectively.

Key words: *Andrena*, *Bombus*, *Cypripedium*, *Dactylorhiza*, Orchidaceae, pollination.

Although a large literature on orchid pollination now exists (recently reviewed by van der Cingel 1995, 2001, Pridgeon *et al.* 1999, 2001), there is still little information regarding the pollination biology of the c. 260 orchid species of Japan. To remedy this paucity, studies on the pollination biology of Japanese orchids have been carried out recently whenever the opportunity arose (*e.g.*, Inoue 1981, 1983, 1985, 1986ab, Sugiura 1995, 1996a, b, Sugiura & Yamaguchi 1997, Sugiura *et al.* 1997, 2001). The present study reports briefly on the pollination biology of two Japanese orchids, *Cypripedium macranthos** Sw. var. *speciosum* (Rolfe) Koidzumi and *Dactylorhiza aristata* (Fisch.) Soó. Of these, the former is designated as a threatened species in Japan (Environment Agency of Japan 2000).

The flowers of the genus *Cypripedium* are known as lady's slipper, in reference to the

shape of the labellum. The pollinators so far recorded include various taxa of bees (Cribb 1997). The flowers of the genus *Dactylorhiza* are usually nectarless, and the principal pollinators seem to be queen bumblebees (Pridgeon *et al.* 2001).

Cypripedium macranthos var. *speciosum*

The study was carried out at Mt. Asama (alt. 2568 m), Nagano Pref., central Japan, on 3 days (June 20-21 and 23, 1999). The study area (alt. c. 1700 m) is classified as a subalpine zone dominated by evergreen conifers (*Abies veitchii* Lindl.). *Cypripedium macranthos* var. *speciosum* thrived in grasslands among coniferous forests along with other blooming plants including *Rhododendron japonicum* (A. Gray) Suringar, *Ranunculus japonicus* Thunb. ssp. *akagiensis* (Hiyama) Tamura, *Euphorbia togakusensis*

* According to Cribb's monograph on the genus *Cypripedium* (Cribb 1997, pp.192-193), "macranthos" is appropriate as epithet while "macranthum" or "macranthon" is often used among researchers.

Hayata, *Convallaria keiskei* Miq. and *Iris sanguinea* Hornem. Lady's slipper occurred sparsely and most patches of lady's slipper included less than 5 flowers, although 30 or more flowers were occasionally found in a single patch. The flowers, placed at a height of 20-30 cm above the ground, were visually conspicuous but have little or no fragrance from a human perspective. Floral color is usually pinkish purple but some flowers are paler. They have no floral nectar or collectable pollen, such that *C. macranthos* var. *speciosum* adopts a deceptive pollination system similar to another variety of *C. macranthos* (*C. m.* var. *rehunense* (Kudo) Miyabe et Kudo), which is pollinated by bumblebee queens (Sugiura *et al.* 2001).

At the study area, fauna of anthophilous insects was not abundant. Only a few families of dipterans (Syrphidae, Anthomyiidae, Calliphoridae) and sweat bees of the genus *Lasioglossum* were found frequently. Bumblebees, including *Bombus heaticola heaticola* Tkalcù, were only rarely seen.

During the study period, approximately 12 hours were spent for observing on flower-visitors of lady's slipper, and behavior was recorded. In addition, some observations of flower-visitors were opportunistically carried out during other fieldwork.

Various taxa of flies including 7 species of syrphid flies, an empidid fly, and some species of anthomyiid fly were occasionally observed to approach and/or visit the flower (>one observation/ hour). In nearly all visits, however, they merely walked on, and occasionally licked, various parts of flowers. Entering the labellum was observed only once in a black syrphid fly (body length, c. 8.5 mm) and in an empidid fly (c. 10 mm), respectively. The syrphid fly landed on labellum, and moved to the staminode before entering the saccate labellum through its upper mouth. Seventeen minutes later, it emerged from

one of two orifices at each side of the column. The empidid fly stayed in the labellum for 138 seconds, and then emerged from the mouth of the labellum. In both individuals, no lady's slipper pollen was found on their body surface because of the small body size or inappropriate behavior during the flower visit. A dead insect adhering to the anther was found 4 times; twice a syrphid fly *Rhingia laevigata* Loew, once an anthomyiid fly, and once an empidid fly, suggesting that those flies are too weak to remove the pollen from the anther.

Skippers, *Thoressa varia* (Murray), were observed twice visiting the flower; they searched around the center of flower with their proboscis.

On June 23, a female of *Andrena ruficrus ruficrus* Hirashima and a worker of the European honeybee *Apis mellifera* L. were collected, just after they had emerged from an orifice with a sticky mass of pollen from one of the lateral anthers deposited on the thorax. Both bees had no pollen loads on their hind legs. In addition, visits of the European honeybee to the flower were observed 4 times; two emerged from the mouth of the labellum without lady's slipper pollen (Fig. 1), and one was found while it buzzed within the labellum. The final one was collected while walking on the labellum.

A male of the sweat bee, *Lasioglossum laeviventre* (Pérez), was once observed entering one of the two orifices, and soon emerged from the other orifice without pollen attachment. Females of *Lasioglossum calceatum calceatum* (Scopoli) and *L. nipponense* (Hirashima) frequently foraged on flowers of *Ranunculus japonicus* ssp. *akagiensis* and *Euphorbia togakusensis* but were also observed visiting lady's slipper flowers. In most cases, they only landed or walked on the flowers, and only once a female of *L. nipponense* visited the flower in an appropriate manner, though it also flew away with no lady's slipper pollen.

Dactylorhiza aristata

The observations were carried out within and around a protected area for a threatened lady's slipper *Cypripedium macranthos* var. *rebunense*, Teppu, Rebun Island, Hokkaido, on late May to June of 1999-2001 (see Sugiura *et al.* 2001, for study area). On Rebun Island, *Dactylorhiza aristata* is common, growing in various types of habitats including roadsides and other disturbed sites. Its upright inflorescences are usually conspicuous. The number of flowers per inflorescence varies greatly. The scentless flowers have a distinct spur but no floral nectar is secreted into it. Flowers are basically deep pinkish purple but color varies among plants (for example, some are paler and whitish).

Queen bumblebees (6 *Bombus pseudobaicalensis* Vogt and 3 *Bombus diversus tersatus* Smith) were collected with hemipollinaria of *Dactylorhiza aristata*, while visiting flowers of the dandelion *Taraxacum officinale* Weber (n=6 bumblebees), *Cypripedium macranthos* var. *rebunense* (n=1), *Pedicularis schistostegia*

Vved. (n=1) or *D. aristata* (n=1). The hemipollinaria were located on the labrum (and occasionally also the clypeus) of the bumblebee's face (Fig. 2). The number of hemipollinaria received per bee varied from 2 to 10 (mean=4.8, n=6) in *B. pseudobaicalensis* and 2 to 5 (3.3, n=3) in *B. diversus tersatus*. Interestingly, three *B. pseudobaicalensis* were also smeared with pollen of *C. macranthos* var. *rebunense* on the thorax. All bumblebees with hemipollinaria of *D. aristata* had no pollen loads on their hind legs, indicating that they had not yet begun collecting food for their first brood and thus were inexperienced foragers. A queen of *Bombus hypocrita sapporoensis* Cockerell was once observed visiting flowers of *D. aristata* but received no hemipollinaria.

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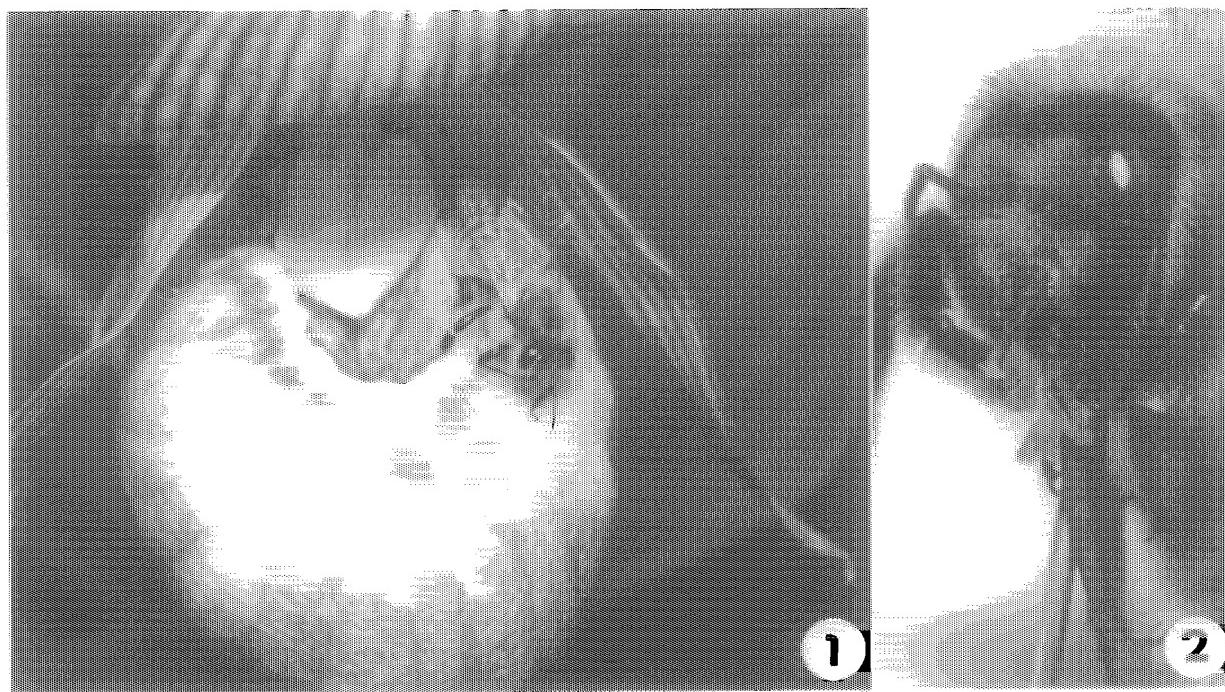


FIG. 1. *Apis mellifera* visiting a *Cypripedium macranthos* var. *speciosum* flower.

FIG. 2. *Bombus pseudobaicalensis* with hemipollinaria of *Dactylorhiza aristata* on its face.

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